Surgical Phase Detection Using Deep Learning
Proposal & Plan

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1 Stated topic and goal

Surgical phase recognition plays a crucial role in the era of digitized surgery. Deep learning solutions have seen great success in endoscopic surgeries. Currently, no prior work has investigated its application in skull-base surgery (Cortical Mastoidectomy). This project will benchmark existing DL solutions and create an innovative DL segmentation algorithm in skull-based surgery.

2 Team members, mentor

- **Students**:

  Xucheng Ma, Xiaorui Zhang, Wenkai Luo

- **Mentors**:

  Max Li, Danielle Trakimas, Dr.Francis Creighton, Prof. Mathias Unberath, Prof. Russ Taylor

3 Relevance/importance

Surgical phase recognition has numerous potential medical applications. Such as automatic indexing of surgical video databases, and optimization of real-time operating room scheduling. It's also a foundation of intelligent context-aware system, which facilitates surgery monitoring, surgical protocol extraction, and decision support.

4 Short technical summary of approach

Kevin

5 Deliverables

6 Timeline & Milestones

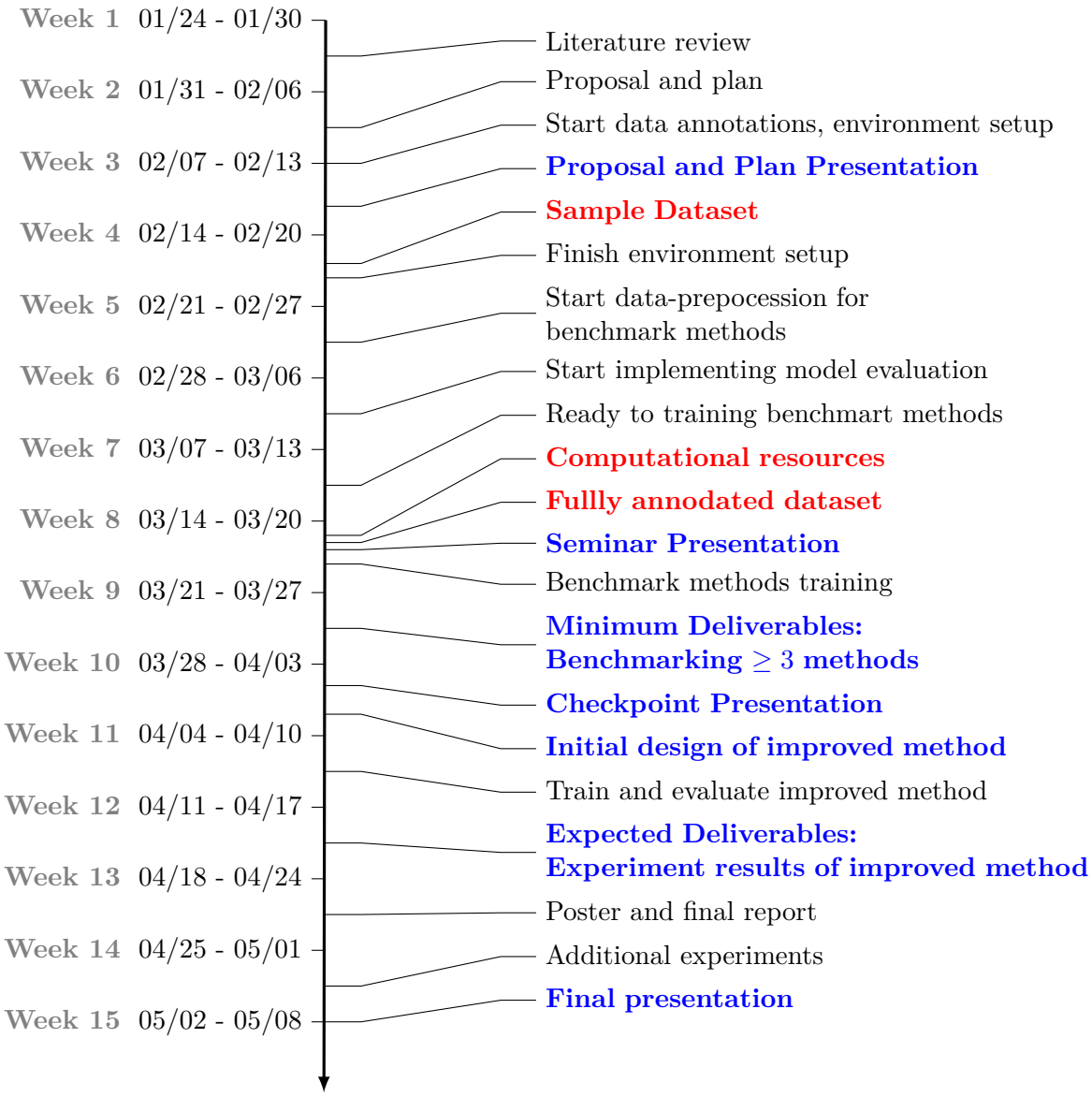

Figure 1: Project timeline, Milestones labeled in blue, Deliverables deadline labeled in red

7 List of dependencies & plan for resolving

1. Dataset & Annotations
   (a) Dataset: Cortical mastoidectomy video dataset provided by JHMI → Need to talk to Dr. Danielle Trakimas to obtain videos.
   (b) Annotation: Phase definition and annotation protocol → Need to talk to Dr. Danielle Trakimas to finalize the annotation protocol and start annotations.

2. Computer, GPU, and server setup

   (a) Computer: Our personal computers with the required packages installed

      i. Environment: Pytorch+torchvision+cuda

      ii. Internet connection to remotely access GPU server.

   (b) GPU resource: ARCADE Lab

      i. ARCADE Lab access → Need to apply and obtain lab access approval from Prof. Mathias Unberath.

      ii. Remote server → Need to set up the remote GPU server service on the ARCADE Lab.

3. Existing Framework & Public dataset

   (a) Existing Framework: Open source frameworks are available online from Paperwithcode and Github

      i. EndoNet: Not available online but should be able to be reproduced.

      ii. MTRCNet-CL: `https://github.com/YuemingJin/MTRCNet-CL`

      iii. Trans-SVNet: `https://github.com/xjgaocs/Trans-SVNet`

   (b) Public dataset:

      i. Cholec80 → Need to apply to CAMMA for dataset access. (`http://camma.u-strasbg.fr/datasets`)

      ii. M2CAI 2016 Challenge Datasets → Need to apply to CAMMA for dataset access. (`http://camma.u-strasbg.fr/datasets`)

4. Clinical advice

   (a) operation analysis

   (b) experiment result analysis

   Need to obtain advice from Dr. Danielle Trakimas.

8 Management Plan

Xucheng

9 Reading list

ALL